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Parameter Optimization for Turbulent Reacting Flows Using Adjoints CAELAN LAPOINTE, PETER E. HAMLINGTON, Univ of Colorado - Boulder — The formulation of a new adjoint solver for topology optimization of turbulent reacting flows is presented. This solver provides novel configurations (e.g., geometries and operating conditions) based on desired system outcomes (i.e., objective functions) for complex reacting flow problems of practical interest. For many such problems, it would be desirable to know optimal values of design parameters (e.g., physical dimensions, fuel-oxidizer ratios, and inflow-outflow conditions) prior to real-world manufacture and testing, which can be expensive, time-consuming, and dangerous. However, computational optimization of these problems is made difficult by the complexity of most reacting flows, necessitating the use of gradient-based optimization techniques in order to explore a wide design space at manageable computational cost. The adjoint method is an attractive way to obtain the required gradients, because the cost of the method is determined by the dimension of the objective function rather than the size of the design space. Here, the formulation of a novel solver is outlined that enables gradient-based parameter optimization of turbulent reacting flows using the discrete adjoint method. Initial results and an outlook for future research directions are provided.

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